

REMARKS

The Office Action mailed on January 5, 2007 has been carefully considered, and the Examiner's comments are appreciated. Claims 1-5 have been amended to clarify ambiguities and overcome art rejections. Claims 6 -11 have been cancelled and thus are withdrawn from consideration. Support for the amendments is located, inter alia, in Applicants' specification, for instance, in paragraphs [0008]-[0009], [0012], [0018]-[0019], and [0021]-[0023], and the original claims.

Claims 1-5 have been rejected under 35 USC 102 for anticipation and under 35 USC 103 for obviousness, and claims 2-5 have been rejected under 35 USC 112, second paragraph, for lack of antecedent basis.

Discussion of Rejection of Claims 1-3 and 5 under 35 U.S.C. §102

Claims 1-3 and 5 stand rejected under 35 USC 102 as being anticipated over the literature reference authored by Petricevic et al. (herein "Petricevic"). According to the examiner, Petricevic discloses a process of making an electrode for a fuel cell that includes: providing a solution of organic precursor aerogel that has resorcinol and formaldehyde; adding a ceramic fiber or carbon fiber to the precursor to form a precursor mixture; gelling the precursor mixture; drying the composite gel in air; and pyrolyzing the composite gel to form an aerogel/carbon composite.

However, Applicant's claims presently require the monolith to also be a fuel, to be prepared by a pyrolysis-accelerating amount of transition metal oxide catalyst, to be wettable, having composites comprising chars and internal reinforcement materials, and the chars being capable of being combusted in a molten salt electrochemical fuel cell in the range from 500 C to 800 C to produce electrical energy. Thus, neither the method of preparation of Applicant's monolith nor Applicant's final product is disclosed or suggested by the Petricevic reference.

The Petricevic reference does not disclose or suggest preparing a fuel. The Petricevic reference does not disclose or suggest controlling the amount of catalyst so as to accelerate a later pyrolysis step. The amount of catalyst utilized in Petricevic would direct one of ordinary skill directly away from Applicant's claimed method. Note, the introductory sentence of the Abstract and the discussion highlighted by the examiner in the Office Action on page 858, "2. Experimental" where the first sentence simply calls out for a resorcinol to catalyst ratio of 1500 to 1---an amount of catalyst that is much less than one to two orders of magnitude smaller than the pyrolysis-accelerating amount employed by Applicant.

Not only is Applicant's method of preparation different than that of Petricevic, but the final product is also different. The finished Petricevic composites are taught to be hydrophobic (see the 1. Introduction and 4. Discussion). On the other hand, Applicant's composites are wettable---particularly for their capability to be soaked in a molten electrochemical fuel cell. Also, materials that are needed to produce hydrophobicity for Petricevic's composites would render Applicant's products not capable of generating electrical energy during combustion. Such can be noted, for instance by Petricevic himself, who teaches several materials (such as silylation methods) in his US Patent 6,503,655 (of record) that would achieve hydrophobicity, but would interfere with the combustion of chars in a molten electrochemical fuel cell and render them useless therein (see, for instance, col. 2, lines 61-64, and col. 5, lines 57 thru col. 6, line 2). Since Petricevic's preference for gas diffusion electrode composites entails open structure for gas diffusion, such electrodes must be hydrophobized to avoid liquid accumulations in the pores whereas Applicant's composites thrive on being wettable by the molten electrolytes of their molten electrochemical fuel cell.

Applicant submits that the method of preparation of Applicant's monolith/fuel as well as the finished product is not disclosed or suggested in Petricevic. The anticipation rejection should be withdrawn.

Discussion of Rejection of Claims 1-5 under 35 U.S.C. §103

The Examiner has again rejected claims 1-5 under 35 USC §103(a) as being unpatentable over Kaschmitter et al. (US 5789338) in view of Boes et al (US 5807494). The Examiner repeats his argument that the Kaschmitter reference teaches a process of making a carbon electrode comprising: providing a solution of organic aerogel or xerogel precursors including a phenol, resorcinol, or catechol and formaldehyde; gelling the precursor mixture to form a composite gel; drying the composite gel; and pyrolyzing the composite gel to form an aerogel/carbon composite or a xerogel/carbon composite. Citing col. 8, line 1 to col. 9, line 27 of Kaschmitter et al. The examiner acknowledges that the reference does not expressly teach adding ceramic materials, glassy materials, or carbon materials and seeks to apply the Boes reference to fill such a void in Kaschmitter et al.

Before addressing the combination of the references, Applicant would submit that in view of the present claims, as amended, that Kaschmitter et al. do not describe or suggest utilizing a pyrolysis-accelerating amount of transition oxide catalyst during preparation of an aerogel or xerogel, and particularly do not disclose such in the presence of internal reinforcement materials incorporated into such gels. More particularly, Kaschmitter et al. provides no motivation for one of ordinary skill in the art to accelerate the subsequent pyrolysis of *undisclosed* internal reinforcement materials with the gels to produce aerogel/carbon composites and/or xerogel/carbon composites by controlling the amount of catalyst utilized relative to resorcinol and the like. Accordingly, a combination of Kaschmitter et al. with other references, without motivation from Kaschmitter et al., does not establish a prima facie case of obviousness and such a rejection should be withdrawn.

The examiner applies the Boes reference as a teaching of adding a carbonaceous component to a precursor solution to form a precursor mixture. Citing col. 3, lines 37-42 and col. 13, lines 41-44, of Boes. The examiner's position, as understood, is that one of ordinary skill in the art would modify the Kaschmitter organic aerogel/xerogel precursors to include a carbonaceous component in order to improve the performance properties of the electrode by lowering the dielectric constant. However, in conjunction with Applicant's arguments in the previous paragraph, Applicant's addition of a pyrolysis-accelerating amount of catalyst is not disclosed or suggested in either cited reference to improve the properties of the electrode for lowering the dielectric constant, or for accelerating the pyrolysis of the gels, or for providing a capability of a product composite containing chars and internal reinforcement materials to have the chars become capable of being combusted in a molten electrochemical fuel cell in the temperature range from 500C to 800C.

Also, from the perspective of Boes, the combination of references does not disclose or suggest the preparation of Applicants' claimed reinforced rigid anode monolith. The addition of a carbonaceous component by Boes is not disclosed or suggested to assist in the integrity of any finished anodic solid materials resulting from processing of materials of Boes. Kaschmitter's aerogels and xerogels are taught to be useful in supercapacitors and strive for relatively high electrical *conductivities*. As alluded to previously, Kaschmitter does not disclose or suggest a need for additional reinforcement of its materials, and makes no mention of controlling the amount of transition metal oxide catalyst that accelerates a later pyrolysis step to prepare Applicant's composites containing chars and internal reinforcement materials. Kaschmitter's intent is to improve conductivity and improve electron flow, but Applicant desires to eventually generate electrical energy from

combustion of the chars after being produced in the pyrolysis step. No prima facie case of obviousness is established by combining the references since Kashmitter's process of preparing the gels has been modified by Applicant.

Both the Boes and Kaschmitter references are flawed with respect to providing teaching of any pyrolysis of its materials once prepared, or any benefits that can be derived from pyrolyzing its materials once incorporated into the Kaschmitter aerogels or xerogels. Applicant's materials function as a rigid monolith that is continually exposed to high temperature molten mixtures from an electrochemical fuel and over time is consumed as a fuel to produce electrical energy. Therefore, Applicant's ceramic materials; glassy materials based on borates, phosphates, or silicates with alkaline earth or transition metal cations; and/or carbon materials are added to provide "internal support to the carbon anode" which would otherwise fall apart due to combustion of chars. It is important to note that Applicant makes no effort to cause the internal reinforcement materials to react covalently or ionically with the aerogels, xerogels or their precursors, as does Boes. Central to Boes' process is a requirement for carbon black (or possibly other carbon materials) to react with one of several molecules that have "at least one ionic group [and] at least one aromatic group...", which creates carbonaceous matter that in turn can react with various gels (none of which seem to be aerogels or xerogels) allowing them to exhibit improved properties. Here again it is important to note that apparently just adding carbon black to the gel without its first reaction with one of Boes' "cross linkers" doesn't improve the properties of the gel. In fact, even after such a "linker" reaction, improved properties may not be evident unless these materials are mixed in just the right quantities at just the right conditions. Therefore, it is difficult to see how one of ordinary skill in the art would turn to Boes' as a source of information about how, when, or if, to add ceramics, borates,

silicates, etc., internal reinforcement materials to aerogels or xerogels produced by a different manner than Kaschmitter.

Applicant repeats his earlier arguments wherein the examiner cites two areas of the Boes reference to buttress his position. (1) Boes, at column 13 lines 41-44 is part of his Example 12 where Modified CB-A, a material modified for such a purpose, is reacted with a gel to achieve improved properties. However, to get these improvements carbon black had to be modified in a detailed procedure outlined in Example 1 in Column 10. Such disclosure does not disclose or suggest utilizing it in combination with Applicant's modified Kaschmitter method and does not disclose any control of a transition metal oxide catalyst to improve later pyrolysis acceleration. (2) Boes, column 3 lines 37-42 makes a rather general statement that "The carbonaceous components of the gel composition of the present inventions may be selected from the group consisting of: a carbon blacks attachable to a gel component, carbon fibers attachable to a gel component, and activated carbons attachable to a gel component, and graphitic carbons attachable to a gel component." But the rest of the paragraph goes on to say that: "(C)ertain carbonaceous components will not become attached to a gel component unless modified. Preferably, the carbonaceous component is chemically modified in the following manner... ." The balance of Boes then goes on to describe in detail the modification process and why these modified compounds work while unmodified materials apparently don't. Accordingly, nowhere is there any indication why, how and where such unmodified materials might work—and is, thus, not enabling. In any event, Boes does not suggest that internal reinforcement material added to a gel precursor would result in a wettable composite, nor one capable of chars being combusted in a molten electrochemical fuel cell in a temperature range from 500C to 800C.

In light of the foregoing, a prima facie case of obviousness has not been established and the obviousness rejection should be withdrawn.

Discussion of the Rejections Under 35 USC §112

The Examiner rejected claims 2-5 under 35 USC §112 citing insufficient antecedent basis for limitation of the claim. Applicants have amended claims 2-5 to provide antecedent basis for the carbon materials. Applicants request that the rejection be withdrawn.

Summary

Applicants therefore respectfully submit that claims 1-5 and new claims 12-20 are in condition for allowance, and requests allowance of the claims. In the event that the Examiner finds any remaining impediment to the prompt allowance of these claims that could be clarified with a telephone conference, he is respectfully requested to initiate the same with the undersigned at (925) 422-7274.

Respectfully submitted,



Dated: April 5, 2007 By:

Alan H. Thompson
Attorney for Applicants
Registration No. 29,981
Lawrence Livermore National Lab
7000 East Avenue, L-703
Livermore, CA 94550
TEL: (925) 422-7274
FAX: (925) 423-2231